IN THE SPECIFICATION

Page 10, line 26 to Page 11, line 7, substitute the following paragraph:

a1

The current command generator 6 in the controller 4 determines a d-axis current command value idr and a q-axis current command value iqr for a torque command value r which should be generated by the motor 1. Here, the d-axis indicates the direction of a magnetic pole position (magnetic flux), while the q-axis indicates the direction orthogonal to the d-axis, thus defining a rotating coordinate system (d-q axes). The relationship between the rotating coordinate system (d-q axes) and a static coordinate system (<u>∝-β</u> axes) is shown in Fig. 2.

Page 11, line 26 to Page 12, line 10, substitute the following paragraph:

a2

As a rotor of the motor 1 having permanent magnets rotates at an angular velocity, the d-q axes also rotate at the angular velocity, so that it is necessary to detect the phase from the static coordinate system (<u>∝-β</u> axes) to the rotating coordinate system (d-q axes), i.e., a magnetic pole position for controlling a current on the d-q axes. In the first embodiment, the carrier synchronized magnetic pole position estimating means **[9]** <u>**30**</u> estimates the magnetic pole position using the u-phase current iu^_ and v-phase current iv^_, which are motor currents, detecting by the current detector 9, without using a position sensor. A signal indicative of the estimated magnetic pole position is supplied to the d-q

A2

converter 8, rotational speed calculating unit 20 and three-phase converter 10, respectively.

Page 12, lines 23 to 30, substitute the following paragraph:

A3

Fig. 3 is a block diagram illustrating the configuration of the carrier synchronized position estimating means **[9]** 30 for use with the synchronous motor control apparatus according to the first embodiment of the present invention, and Fig. 4 is an explanatory diagram showing the relationship between a phase d of a current difference vector and a phase c of the d-axis in the control system in the position estimating means **[9]** 30.

Page 13, lines 8 to 30, substitute the following paragraph:

A4

The position calculating means 32 in the magnetic pole position estimating means 30, which is in principle based on the saliency (Ld≠ Lq), applies a voltage pulse vdh for position estimation in the direction of the d-axes (c) in the control system (direction of estimated magnetic pole position **[^]** ø^). Representing the difference between a current difference value in a positive (+) potential section of a pulse generated by applying this voltage pulse vdh and a current difference value in a negative (-) potential section of the pulse (hereinafter the difference in the current difference value between the positive potential section and the negative potential section is referred to as the "current difference disparity) as a vector, the phase d of the current difference disparity and the phase c of the d-axis in the control system are defined in a relationship as shown in Fig. 4. As shown in Fig. 4, when the phase d of the current

A4

difference disparity vector generated by applying the voltage pulse is made identical to the phase c of the d-axis in the control system., the difference between the magnetic pole position of the motor and the phase c of the d-axis in the control system, i.e., a positional error is zero. In other words, the magnetic pole position can be estimated.

Page 15, lines 9 to 21, substitute the following paragraph:

A5

It should be noted however that since the inductance of a synchronous motor having a saliency changes at a period of 180° of the magnetic pole position, the magnetic pole position can be estimated by the magnetic pole estimating method based on the inductance over a limited range of 180°. Therefore, the carrier synchronized position estimating means 30 cannot determine whether a resulting estimated magnetic pole position direction is in the N-pole direction (-) or in the S-pole direction (+) at the time the motor is started. To overcome this inconvenience, the carrier synchronized position estimating means 30 comprises a polarity discriminating means 34 for discriminating the polarity of an estimated magnetic pole position.

Page 16, line 23 to page 17, line 2, substitute the following paragraph:

A6

While the carrier synchronized magnetic pole position estimating means 30 of the first embodiment is capable of estimating the magnetic pole position over a wide range from an inoperative state to a high speed operation, the magnetic pole position estimating means 30 principally relies on the inductance characteristic of the motor, so that it cannot discriminate whether the position

A6

estimated at the start of the motor corresponds to the N-pole direction (-direction) or the S-pole direction (+ direction).

Page 17, line 25 to page 18, line 9, substitute the following paragraph:

A7

At steps S6, S7, the estimating means 30 discriminates the polarity of the estimated magnetic polarity position direction based on the result of comparison at step S5. Specifically, at step S6, if the current difference value in the d-axis direction in the control system is larger than the threshold, the estimating means 30 determines the N pole since Ld is similar, and defines the d-axes direction in the control system as an estimated magnetic pole position **ø^**. On the other hand, at step S7, if the current difference value in the d-axes direction in the control system is smaller than the threshold, the estimating means 30 determines the S pole since Ld is larger, and corrects the d-axis direction in the control system by 180° to define corrected direction as an estimated magnetic pole position **ø^.**

Page 19, line 17 to page 20, line 4, substitute the following paragraph:

A8

After the carrier synchronized magnetic position estimating means 30 determines the estimated magnetic pole position **ø^** at the time of starting, the polarity need not be discriminated in principle. The estimation of position can be continued only with the position calculating means 32 except for the polarity determining means 34, after the motor is started. However, then the motor is not in operation, the polarity discriminating means 34 may be operated at predetermined time intervals to check the polarity of the currently estimated

magnetic pole position **ø^** for effectively preventing the inversion of the polarity. If this check shows that the polarity determined by the polarity discriminating means 34 differs from the polarity of the currently estimated magnetic polarity position **ø^**, the polarity should be corrected. In this way, even if the polarity of the estimated magnetic pole position **ø^** has been inverted by some cause while the motor is not in operation, the polarity can be promptly corrected.

a8

Page 23, lines 8 to 19, substitute the following paragraph:

In the third embodiment, a fault detector 40A comprises an input power calculating unit 44 instead of the instantaneous power calculating unit 41 illustrated in Fig. 6. The input power calculating unit [14] 44 calculates input power from a product of a DC voltage VB of a battery 2 detected by a resistor 25 and a DC current IB detected by a current sensor 26. A phase inversion determining unit 43 relies on the input/output relationship between an operation mode determined by the operation mode processing unit 42 and the input power calculated by the input power calculating unit [41] 44 to determine that an estimated magnetic pole position is inverted.

a9

Page 29, line 29 to page 30, line 17, substitute the following paragraph:

A fault detector 40D comprises a phase inversion determining unit 43D. The phase inversion determining unit 43 D determines that the estimated magnetic pole position is inverted, in relation to a changing rate **Δø** of an estimated magnetic pole position outputted by a magnetic pole position estimating means 30.

a10

A10 cont'd.

The carrier synchronized position estimating means 30 may experience, by some cause, inversion of estimated magnetic pole position, out-of-synchronization, and oscillation of the estimated magnetic pole position. To detect this oscillation, the phase inversion determining unit 43D monitors a changing rate **Δø** of the estimated magnetic pole position. Since the magnetic pole position may vary in a maximum operating frequency range, the oscillation or the like, if any, would result in an extremely large changing rate of the estimated magnetic pole position. It is therefore possible to detect the oscillation when the changing rate exceeds a certain set value, which is determined from the maximum operating frequency.

Page 31, lines 10 to 22, substitute the following paragraph:

A11

A body 100 of the electric vehicle is supported by four wheels 110, 112, 114, 116. Since the illustrated electric vehicle is forward-wheel driven, a motor 1 is directly coupled to a front axle 154. A controller 4 controls a driving torque of the motor 1. A battery 2 is provided as a power source for the controller 4. The power from the battery 2 is supplied to the motor 1 through the controller 4 to drive the motor 1, and rotate the wheels 110, 114. The rotation of a steeling wheel 150 is transmitted to the two wheels 110, 114 through a transmission mechanism comprised of a **[steeling gar]** **steering gear** 152, a tie rod, knuckle are, and so on to change the angle of the wheels.